PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

United States Patent and Trademark Office
(Box PCT)
Crystal Plaza 2
Washington, DC 20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 22 June 1999 (22.06.99)	
International application No. PCT/GB98/03207	**Applicant's or agent's file reference** 07 32633
International filing date (day/month/year) 27 October 1998 (27.10.98)	**Priority date** (day/month/year) 03 November 1997 (03.11.97)
Applicant HOVELL, Simon, Alexander et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

21 May 1999 (21.05.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Lazar Joseph Panakal
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
07 32633		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 98/ 03207	27/10/1998	03/11/1997
Applicant		
BRITISH TELECOMMUNICATIONS PUBLIC L. C. ...et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] **Certain claims were found unsearchable** (see Box I).

2. [ ] **Unity of invention is lacking** (see Box II).

3. [ ] The international application contains disclosure of a **nucleotide and/or amino acid sequence listing** and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] Transcribed by this Authority

4. With regard to the **title,**
   - [X] the text is approved as submitted by the applicant
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   - [X] the text is approved as submitted by the applicant
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this International Search Report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is:

   Figure No. 1
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 98/03207

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G10L3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G10L G06K G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 27872 A (BRITISH TELECOM) 12 September 1996 see page 14, line 1 - line 12 --- -/--	1,3,4, 11,12, 15,16, 18,19, 23,24, 27,28

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
4 December 1998	04/01/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lange, J

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Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	ARTZY ET AL.: "The theory, design, implementation and evaluation of a three-dimensional surface detection algorithm" PROCEEDINGS OF SIGGRAPH 1980 - SEVENTH ANNUAL CONFERENCE ON COMPUTER GRAPHICS AND INTERACTIVE TECHNIQUES, vol. 14, no. 3, 14 - 18 July 1980, pages 2-9, XP002086849 SEATTLE, WA, US see paragraph 1 ---	1,15,16
A	DONG ET AL.: "Design of a partially activated neural network" PROCEEDINGS OF ICNN'95 - INTERNATIONAL CONFERENCE ON NEURAL NETWORKS, vol. 3, 27 November 1995 - 1 December 1995, pages 1282-1286, XP002086850 PERTH, WA, AU see paragraph 3 ---	1,15,16
A	EP 0 392 728 A (TEXAS INSTRUMENTS) 17 October 1990 see page 3, line 25 - page 5, line 40 ---	1,15,16
A	LUCKE: "Bayesian Belief Networks as a tool for stochastic parsing" SPEECH COMMUNICATION, vol. 16, no. 1, January 1995, page 89-118 XP004014230 AMSTERDAM, NL see page 94 - page 95 see page 102 -----	1,15,16

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 98/03207

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9627872 A	12-09-1996	AU 4887696 A	23-09-1996
		CA 2211636 A	12-09-1996
		EP 0813735 A	29-12-1997
		NO 974097 A	08-09-1997
EP 0392728 A	17-10-1990	US 4977598 A	11-12-1990
		DE 69028430 D	17-10-1996
		DE 69028430 T	27-03-1997
		JP 3062000 A	18-03-1991

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PATENT COOPERATION TREATY

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REC'D 11 FEB 2000
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
07 32633		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB98/03207	27/10/1998	03/11/1997
International Patent Classification (IPC) or national classification and IPC		
G10L3/00		
Applicant		
BRITISH TELECOMMUNICATIONS PUBLIC L. C. ...et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
21/05/1999	09.02.2000
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer La Gioia, C Telephone No. +49 89 2399 2418

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB98/03207

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-3,5-17	as originally filed			
4	as received on	06/11/1999	with letter of	04/11/1999

Claims, No.:

1-6,15-18,27,28	as originally filed			
7-14,19-26	as received on	06/11/1999	with letter of	04/11/1999

Drawings, sheets:

1/9-9/9	as originally filed

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	5-10,20-22,27,28
	No:	Claims	1-4,11-19,23-26
Inventive step (IS)	Yes:	Claims	5-10,20-22,27,28
	No:	Claims	1-4,11-19,23-26
Industrial applicability (IA)	Yes:	Claims	1-28
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

SECTION V

A. The following documents have been considered for the purposes of this report:

D1= WO-A-96 27872

D2= Dong et al: "Design of a partially activated neural network", PROCEEDINGS OF ICNN 95 - INTERNATIONAL CONFERENCE ON NEURAL NETWORKS, vol. 3, 27 Nov - 1 Dec 1995, pages 1282-1286, XP002086850 PERTH, WA, AU

D3= EP-A-0 392 728

B. The present application does not satisfy the criterion set forth in Article 33(2) PCT because the subject-matter of independent claims 1, 15 and 16 is not novel, for the following reasons.

D1 discloses (see D1, page 5, line 5 to page 9, line 11; page 13, line 18 to page 14, line 12) a pattern recognition method comprising the steps of:
applying a generated data sequence representative of an input signal to a set of active models of a network;
selecting a subset of the outputs of the members of said set according to a predetermined criterion (see D1, page 11, lines 15 to 30; page 13, lines 18 to 22: tokens are erased if they carry a score which falls below a threshold value; the tokens in D1 correspond to the outputs in the language of claim 1); and
adding further models to said set according to said selected outputs;
wherein the further models receive said selected outputs as inputs, a model output representing a degree of matching of an input data sub-sequence with the sub-pattern represented by the model.

C. Being the features defined in dependent claims 2 to 4, 11 to 14, 17 to 19 and 23 to 26 either features disclosed or hinted by D1 or design measures which one would regard as expected from the skilled person, they are therefore not

considered to introduce any new subject-matter or impart any inventive step to any of these claim combinations.

SECTION VII

A. Reference signs in parentheses should have been inserted in the claims to increase their intelligibility, Rule 6.2(b) PCT.

B. The independent claims are not cast in the two part form, thus the requirements of Rule 6.3(b) PCT are not met.

C. The documents D1 to D3 have not been identified in the description nor has the relevant background art disclosed therein been discussed. The requirements of Rule 5.1(a)(ii) PCT are, thus, not fulfilled.

SECTION VIII

A. Claims 27 and 28 are not allowable under Rule 6.2(a) PCT since they rely, in respect of technical features of the invention, on references to the description and drawings.

Young, S.J. et al., "Token Passing: a Simple Conceptual Model for Connected Speech Recognition Systems".

The nature of the models themselves is not of critical importance. They may be, for instance, neural networks. However, if finite state models are used, it is preferable that pruning be carried out between the application of successive data elements of said sequence to the network. This pruning preferably comprises assessing values at each state of the models of the network and deactivating those states that do not meet a predetermined criterion. In this case, the set of models is advantageously dynamic and pruning removes models when all of their states have been deactivated.

Preferably, the criterion applied to the model outputs is harsher than the criterion applied to states within a model.

Preferably, the application of the criterion applied to model outputs comprises creating a histogram of output states on the basis of their values and selecting those states in the bins of the histogram which do not contain the states having the best m values, where m is an integer. Preferably also, the application of the criterion applied to all model states comprises creating a histogram of states on the basis of their values and selecting those states in the bins of the histogram which contain the states having the best n values, where n is an integer, for deactivation. In this way the growth of the number of instantiated models can be predicted and the time taken for the processing is prevented from becoming excessive.

The present invention is particularly applicable to speech recognition. In a speech recognition apparatus according to the present invention, the data generation means preferably comprises feature extraction means for extracting characterising features from an audio signal.

7. A method according to claim 5 or 6, wherein the criterion applied to the model outputs is harsher than the criterion applied to states within models.

8. A method according to any one of claims 1 to 7, wherein the application of the criterion applied to model outputs comprises creating a histogram of model outputs on the basis of their values and selecting those outputs in the bins of the histogram which do not contain the outputs having the best m values, where m is an integer.

9. A method according to claim 8, wherein model outputs are selected by setting output that are not selected to a predetermined value.

10. A method according to any one of claims 5 to 7, wherein the application of the criterion applied to all model states comprises creating a histogram of states on the basis of their values and selecting those states in the bins of the histogram which contain the states having the best n values, where n is an integer, for deactivation.

11. A method of speech recognition according to any one of claims 1 to 10.

12. A method according to claim 11, wherein the models comprises models of sub-word vocalisations.

13. A method of generating a speech signal comprising performing a method according to claim 11 or 12, and operating a speech synthesizer in dependence on the result of performance of said method.

14. A method of operating a telephone switching centre comprising performing a method according to claim 11 or 12 and commanding a telephone switching centre for the purpose of establishing a telephone connection in dependence on the result of the performance of said method.

first set of models is performed between the applications of successive data sequence elements.

19. A method according to claim 18, wherein each model comprises a finite state network

20. An apparatus according to claim 19, including means for assessing the values for each state of members of said set and deactivating those states that do not meet a predetermined criterion, between the applications of successive data sequence elements.

21. An apparatus according to claim 20, wherein a model is removed from said set is all of its states have been deactivated.

22. An apparatus according to claim 20 or 21, wherein the criterion applied to the model outputs is harsher than the criterion applied to states within models.

23. A speech recognition apparatus according to any one of claims 16 to 22.

24. An apparatus according to claim 23, wherein the models comprise models of sub-word vocalisations.

25. An apparatus for generating a speech signal comprising performing an apparatus according to claim 23 or 24, and a speech synthesizer configured for operation in dependence on the operation of the speech recognition apparatus.

26. A telephone network apparatus comprising an apparatus according to claim 23 or 24 and a telephone switching centre, wherein the telephone switching centre operates to establish a telephone connection in dependence on the operation of the speech recognition apparatus.

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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G10L 3/00

A1

(11) International Publication Number: WO 99/23640

(43) International Publication Date: 14 May 1999 (14.05.99)

(21) International Application Number: PCT/GB98/03207

(22) International Filing Date: 27 October 1998 (27.10.98)

(30) Priority Data:
9723214.4 3 November 1997 (03.11.97) GB

(71) Applicant *(for all designated States except US)*: BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY [GB/GB]; 81 Newgate Street, London EC1A 7AJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: HOVELL, Simon, Alexander [GB/GB]; 72 Malvern Road, Cambridge CB1 4LD (GB). WRIGHT, Mark [GB/GB]; 292 Blue Boar Lane, Sprowston, Norwich, Norfolk NR7 8RZ (GB). RINGLAND, Simon, Patrick, Alexander [GB/GB]; 48 Carlford Close, Martlesham Heath, Ipswich, Suffolk IP5 3TB (GB).

(74) Agents: GEARY, Stuart, Lloyd et al.; Venner, Shipley & Co., 20 Little Britain, London EC1A 7DH (GB).

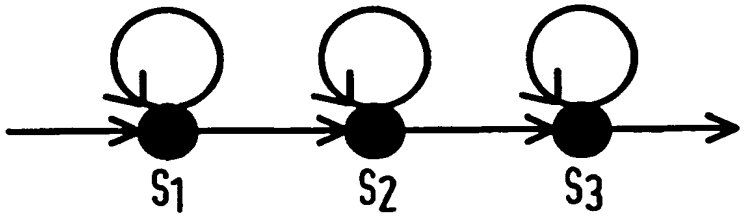
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: PATTERN RECOGNITION

(57) Abstract

A method and apparatus recognising a pattern comprising a sequence of sub–patterns, a set of possible patterns is modelled by a network of sub–pattern models. One or more initial software model objects are instantiated first. As these models produce outputs, succeeding model objects are instantiated if they have not already been instantiated. However, the succeeding model objects are only instantiated if a triggering model output meets a predetermined criterion. This ensures that the processing required is maintained at a manageable level. If the models comprise finite state networks, pruning of internal states may also be performed. The criterion applied to this pruning is less harsh than that applied when determining whether to instantiate a succeeding model. The invention is applicable to speech recognition amongst other applications.



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